Pharmacy Education (2021) 21(1) 528 - 537
https://doi.org/10.46542/pe.2021.211.528537

RESEARCH ARTICLE

Medication reconciliation knowledge among hospital pharmacists in Nigeria: A non-randomised controlled trial

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Keywords
Knowledge assessment
Medication
Non-randomised controlled trial
Pharmacist
Reconciliation

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Abstract

Background: Medication reconciliation (MR) is a patient-centred evolving role of pharmacists that improves patient's health outcomes. **Aim**: To assess the effect of an educational intervention on pharmacists' MR knowledge in two Nigerian tertiary hospitals. **Methods**: A two-arm parallel non-randomised controlled trial was carried out at two tertiary hospitals in Nigeria, one as intervention and the other as control site. Pharmacists' MR knowledge was assessed pre-intervention and at one-, three- and six-month post-intervention. The intervention consisted of seminar and role-plays. Data were summarised with descriptive and inferential statistics. **Results**: A total of 75 pharmacists completed the study. Scores for pre-intervention out of a total of 38 was 19.31±4.76 in the intervention group and 17.50±6.86 in the control group. Post-intervention assessment scores (University College Hospital *vs* University of Ilorin Teaching Hospital) at one, three and six months were 29.82±5.01 vs 25.97±5.31, 31.53±4.99 vs 26.10±5.20, and 31.69±4.10 vs 23.07±3.98, respectively ($p < 0.01$). **Conclusion**: The educational intervention led to improved pharmacists' MR knowledge.

Introduction

Medication error poses substantial health and economic consequences, including unnecessary increase in hospital visit, avoidable drug-related hospital admissions, and mortality (Masotti *et al.*, 2010). Unwanted consequences of medication errors include undesirable interactions, adverse drug reactions, inadequate patient adherence, medication ineffectiveness, and reduction in quality of life (WHO, 2016). Medication reconciliation addresses negative patient outcomes which may arise due to patient's inadequate knowledge of medications, work schedule of healthcare practitioners, and poor management of patient health records during transition of healthcare (Barnsteiner, 2008; Kwan *et al.*, 2013). Medication reconciliation is one of the strategies to reduce medication errors to the barest minimum (Rozich and Resar, 2001; Kane-Gill *et al.*, 2010; Buckley *et al.*, 2013).

Medication reconciliation is carried out on admission and at every junction of transition in healthcare delivery. These transitions of care comprise alterations in healthcare setting, services, professional or degree of care (IHI, 2011). The steps involve garnering a comprehensive medication history list for patients and matching it with the written medication orders to rule out unintended discrepancies (Gleason *et al.*, 2012). Patient is counselled on adjustments made to medications, and a comprehensive current medication list is provided for the next healthcare provider.

Medication reconciliation identifies and resolves medication discrepancies in patients across transitions of care. However, medication discrepancies could be intentional or unintentional (Kwan *et al.*, 2013). Most in-patients (67%) have unintended medication discrepancies, as reported by Tam *et al.* (2005). The number of unintended medication discrepancies with potential to cause harm falls between 11% to 59% of all

discrepancies based on various studies (Cornish *et al*., 2005; Kwan *et al*., 2007; Wong *et al*., 2008; Kwan *et al*., 2013), yet 40-80% of patients do not experience clinically significant unintended medication discrepancies.

In a systematic review and meta-analysis (Mekonnen *et al.*, 2016a), pharmacist-managed medication reconciliation intervention at single transition points in the hospital (whether at admission or discharge) led to reduction in medication discrepancies and identification of more clinically relevant medication discrepancies. In a related review, Mekonnen and others (2016b) reported that pharmacist-led medication reconciliation resulted in 19% reduction in all-cause readmissions, 28% reduction in all-cause emergency department visits, and 67% reduction in adverse drug event-related hospital revisits.

In a survey carried out in a hospital and its surrounding health community services in the Netherlands, health care professionals acknowledged the lack of awareness of the number of medication errors and its implications on the patients' welfare, inadequate knowledge on the performance of medication reconciliation and who should perform the task (van Sluisveld *et al*., 2012). This is supported by a study carried out in Oman by Al-Hashar and others (2017), who reported that despite the acknowledgement of the physician, nurses and pharmacists of the importance of conducting medication reconciliation service, there is a lack of consensus on whose responsibility it is.

Few countries in sub-Sahara Africa, such as Ethiopia (Mekonnen *et al*., 2016a, 2016b, 2018) and South Africa (Subrayen and Schellack 2016; Naicker *et al*., 2018) have conducted studies on medication reconciliation. Since there is a dearth of literature on the knowledge and practice of medication reconciliation among health practitioners in Nigeria, this study sought to evaluate the knowledge of hospital pharmacists on medication reconciliation and provide an educational intervention to improve identified deficiencies.

Methods

Study design and setting

A two-arm parallel non-randomised controlled trial was carried out among pharmacists in two Nigerian tertiary hospitals. The University College Hospital (UCH), Ibadan, a 950-bed teaching hospital affiliated with University of Ibadan, served as the intervention site. The control site was the University of Ilorin Teaching Hospital (UITH), Ilorin, a 650-bed teaching hospital affiliated with University of Ilorin. Both study sites are major referral centres.

Study participants

There were 118 pharmacists at UCH and 68 pharmacists at UITH at the commencement of the study. All the pharmacists were invited to participate in the study after the detail had been explained to them. Only those who gave verbal informed consent participated in the study from April to December 2019. Pharmacists who gave informed consent but were unavailable at the time of the distribution of the questionnaire or those who declined further consent were excluded from further participation at each stage of the study, as outlined in Figure 1.

Data collection tool and administration

A semi-structured questionnaire assessing medication reconciliation knowledge of the pharmacists was self-administered at both study sites. The semi-structured questionnaire was evaluated for content validity by three lecturers at the Department of Clinical Pharmacy and Pharmacy Administration, Faculty of Pharmacy, University of Ibadan, Nigeria. Face validity was done by pre-testing the questionnaire among eight pharmacists at the University Health Services, University of Ibadan, and five pharmacists at the Military Hospital, Ojoo, both in Ibadan, Nigeria. A few questions were modified based on responses from the face and content validity, such as rewording some phrases for clarity. Cronbach alpha coefficient range for the knowledge scale for the study was 0.63 – 0.78.

An identifier code was generated by the participants from their demographic characteristics to facilitate ease of matching the pre-and post-intervention data and was used for each participant. The questionnaire had two sections: Section A consisted of the socio-demographic characteristics of the participants; Section B comprised an 18-item assessment of the pharmacists' knowledge of key concepts involved in medication reconciliation. These included critical points for the medication reconciliation role of health professionals, source of comprehensive patients' medication history, steps involved in medication reconciliation, and participants' knowledge on communication skills. Also addressed were details of what should be documented during the process of medication reconciliation and list of categories of drug therapy problems, based on the classification by Cipolle *et al*. (2012).

The questionnaire was administered to consented pharmacists at their place of practice and collected immediately after completion. The questionnaire took 20 minutes to fill on the average. It was administered at baseline and at one-, three-, and six-month post-intervention.

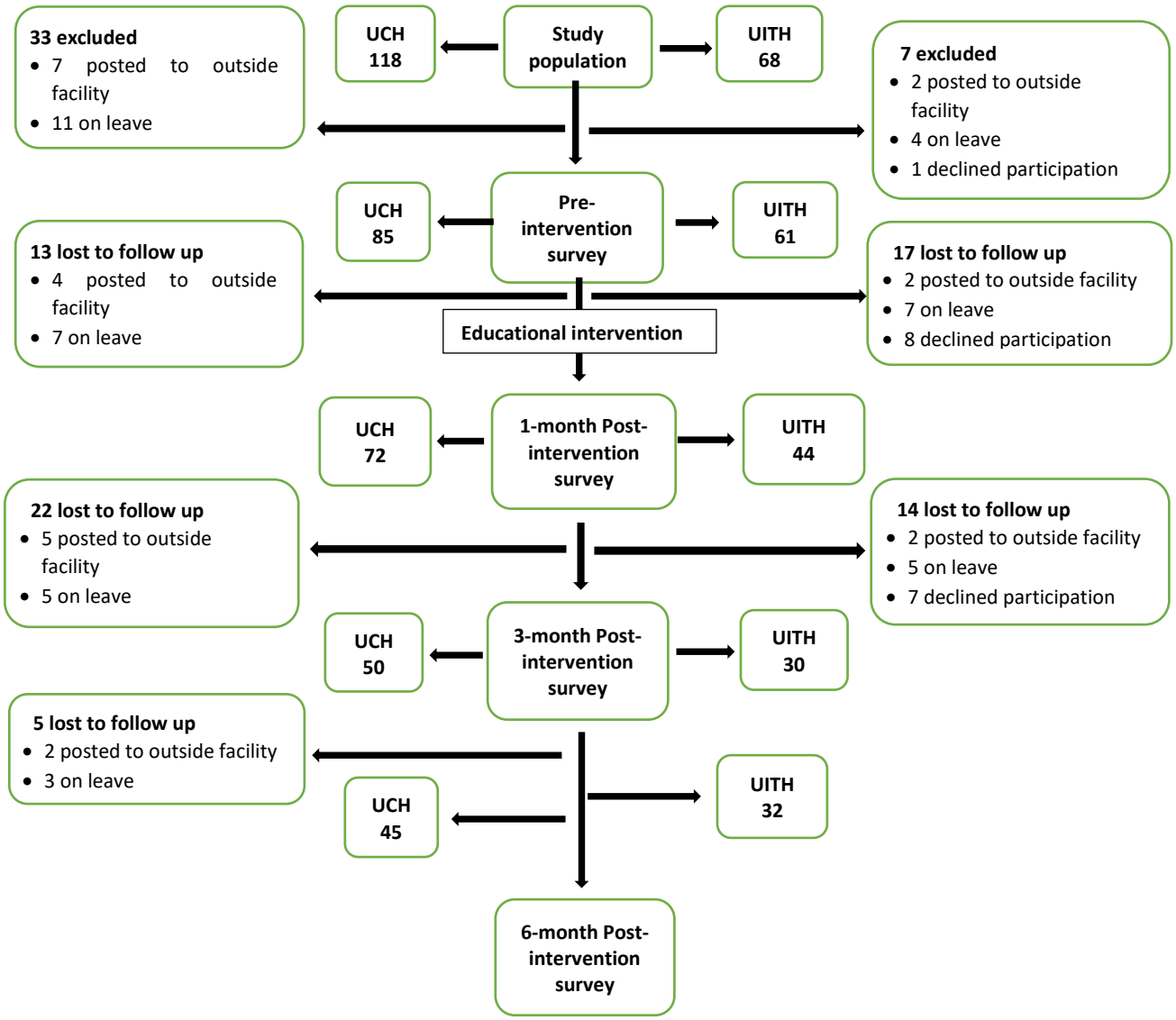

Figure 1: Consolidated Standards of Reporting Trials (CONSORT) flow diagram for study participants

UCH = University College Hospital (Intervention site), UITH = University of Ilorin Teaching Hospital (Control site), PI = Post-intervention

Intervention

A four-hour training workshop for educational intervention was tailored to address the identified deficiencies in knowledge found among the pharmacists at baseline data collection. It was carried out among 85 pharmacists at the University College Hospital, the intervention site. The training workshop comprised didactic lectures on detailed patient medication history taking, identification and resolution of drug therapy problems, documentation of pharmaceutical care activities, medication reconciliation procedure, and the role of communication skills in medication reconciliation.

Theoretical cases were also discussed, and role-plays acted out. A month after the training workshop, the questionnaire was re-administered to the pharmacists at both study sites. This process was repeated at three- and six-month post-intervention.

Each correct response in Section B of the questionnaire was assigned a score of "1" while the incorrect response was assigned a score of "0". Questions with multiple answers, such as definitions and items that required listings, had multiple scores. The total obtainable score was 38. Percent medication reconciliation knowledge was determined by dividing pharmacists' scores with the total obtainable score and multiplying by 100. The mean percent score was further categorised by consensus as poor (< 50%), fair (50 – 69.9%), good (70 – 89.9%) and excellent (90 – 100%).

Data analysis

Data were summarised with descriptive statistics such as frequency counts, percentages, and mean ± standard deviation. Chi-square (linear-by-linear association) was used to determine the differences in the demographic variables (such as gender, years of hospital practice, and educational qualifications) of the pharmacists in the intervention and control group. It was also used to determine the differences in the categories of medication reconciliation knowledge at pre-intervention and at one-, three-, and six-month post-intervention in the intervention group and the control group. Independent-samples t-test was used to evaluate the differences in the means of pharmacists' medication reconciliation knowledge score between the control and the intervention group at pre-intervention and at one-, three-, and six-month post-intervention. While analysis of covariance was used to evaluate the mean difference in the pharmacists' medication reconciliation knowledge scores at pre-intervention, one-, three-, and six-month post-intervention, while controlling for gender and educational qualification. The level of statistical significance was set at $p < 0.05$.

Ethical approval

Approval for the study was granted by the University of Ilorin Teaching Hospital Ethics Research Committee (ERC/PAN/2018/08/1814) and the joint University of Ibadan/University College Hospital Health Research and Ethics Committee (UI/EC/15/0308). The study was registered on ClinicalTrials.gov (ID NCT03182972).

Results

Out of the 118 pharmacists in UCH, the intervention site, 85 participated in the pre-intervention survey and 45 at six months post-intervention. Also, at UITH, the control site, 61 out of the 68 pharmacists participated in the pre-intervention survey while 32 participated six months post-intervention. Reasons for the reduction in the number of participants at each stage are given in Figure 1. The demographics of the participants are shown in Table I.

Table I: Demographic characteristics of the study participants at baseline

	UCH (n = 85)		UITH (n = 61)		
Variables	**Frequency**	**%**	**Frequency**	**%**	***p* value[a]**
Gender					
Female	57	67.1	30	49.2	0.040*
Male	28	32.9	31	50.8	
Years of hospital pharmacy experience					
1 – 5 years	45	52.9	42	68.9	0.181
6 – 10 years	16	18.8	4	6.6	
> 10 years	24	28.2	15	24.6	
Educational qualification(s)					
B.Pharm. only	48	56.5	46	75.4	0.030*
FPCPharm	13	15.3	6	9.8	
MBA	0	0	1	1.6	
Ph.D.	1	1.2	0	0	
MBA + FPCPharm	1	1.2	1	1.6	
M.Pharm./M.Sc./MPH	9	10.6	4	6.6	
M.Sc. + FPCPharm	13	15.3	3	4.9	

[a] Chi square (Linear-by-linear association); * $p < 0.05$; UCH = University College Hospital; UITH = University of Ilorin Teaching Hospital; B. Pharm.: = Bachelor of Pharmacy; MBA = Master of Business Administration; M.Sc. = Master of Science; MPH = Master of Public Health; M.Pharm = Master of Pharmacy; FPCPharm = Fellow Postgraduate College of Pharmacists; Ph.D. = Doctor of Philosophy

The baseline medication reconciliation knowledge score in the intervention group (17.74 ± 5.78) and the control group (17.90 ± 8.25) was not significantly different ($p = 0.896$). On average, the participants could only state one out of the three steps and the three critical care points in medication reconciliation.

One hundred and thirty-two (90.4%) of the study participants thought that pharmacists could solely carry out medication reconciliation, and they could not differentiate between medication history taking and medication reconciliation. They could barely list three out of eight drug therapy problems, and they could not define medication reconciliation. Most of the participants thought that the judgmental approach could be used when necessary during patient counselling (Table II). The comparative analysis of the medication reconciliation knowledge of pharmacists

that completed the study, that is, 45 in the intervention group and 30 in the control group, showed average scores of 19.31 ± 4.76 in the intervention group and 17.50 ± 6.86 in the control group (p = 0.181).

Table II: Baseline medication reconciliation knowledge of study participants

Questions	Pre-Intervention		
	UCH (n = 85)	UITH (n = 61)	*p* value[a]
	Mean ± SD		
1. Define CPMH	0.98±0.64	1.07±0.68	0.419
2. List three sources of generating CPMH	2.20±0.84	2.03±1.24	0.363
3. Define MR	0.69±0.82	0.97±0.89	0.057
4. What are the MR steps?	0.56±0.76	1.15±1.17	0.001*
5. Which professional is solely involved in MR?	0.07±0.26	0.13±0.34	0.245
6. What are the three care points for MR?	0.59±0.82	0.38±0.86	0.135
7. Differentiate between MH and MR	0.34±0.48	0.30±0.46	0.560
8. What percentage of drugs should be in CPMH?	0.78±0.42	0.67±0.47	0.171
9. Must patients know all medication indications?	0.87±0.34	0.85±0.36	0.755
10. Are dietary supplements part of CPMH?	0.87±0.34	0.79±0.41	0.196
11. Are non-oral medications part of CPMH?	0.98±0.31	0.97±0.32	0.123
12. Give two examples of non-oral medications	1.58±0.76	1.41±0.80	0.205
13. What is the proof of PC activities?	0.41±0.50	0.23±0.42	0.018*
14. What is the relevance of lab. result review?	0.69±0.46	0.62±0.50	0.373
15. List three pharmacist-patient comm. barriers	2.12±0.97	1.66±1.14	0.011*
16. List two pharmacist-physician comm. barriers	1.27±0.78	1.02±0.89	0.068
17. When is judgmental approach used for patients?	0.29±0.46	0.13±0.34	0.015*
18. List the drug therapy problems	2.73±2.21	3.89±3.06	0.013*
MR knowledge mean score ± Standard deviation	18.19 ± 5.44	18.52 ± 7.67	0.757
Expected total score	38	38	
MR knowledge[c]	**Freq. (%)**	**Freq. (%)**	***p* value[b]**
Poor knowledge (0-49.9%)	42 (49.4)	26 (42.6)	0.276
Fair knowledge (50 - 69.9%,)	39 (45.9)	29 (47.5)	
Good knowledge (70 - 89.9%)	4 (4.7)	6 (9.8)	
Excellent knowledge (90 - 100%)	0 (0.0)	0 (0.0)	

MR = Medication reconciliation, CPMH = Comprehensive patient medication history, Comm. = Communication, PC = Pharmaceutical care, Lab. = Laboratory, SD = Standard deviation, MH = Medication history, Freq. = Frequency

[a] Independent-samples t-test; [b] Chi square (Linear-by-linear association), UCH = University College Hospital (Intervention site), UITH = University of Ilorin Teaching Hospital (Control site); [c] Percentage medication reconciliation knowledge = (MR knowledge total score/Expected total score) x 100%

*$p < 0.05$

Sixty-nine (92.0%) of the study participants thought that pharmacists could solely carry out medication reconciliation, and they could not differentiate between medication history taking and medication reconciliation. They could barely list three out of eight drug therapy problems, and they could not define medication reconciliation.

At one month post-intervention, the medication reconciliation knowledge score was higher ($p < 0.001$) in the intervention group (29.82 ± 5.01) than the control group (25.97 ± 5.31). Similar results to the one-month post-intervention were obtained at three- and six months post-intervention (Table III). Assessment of baseline medication reconciliation knowledge score showed that majority of the pharmacist in the intervention group, 19 (42.2%), and the control group, 14 (46.7%) (p = 0.576), had poor medication reconciliation knowledge at baseline. However, a one-month post-intervention assessment of medication reconciliation knowledge showed that 21 (46.7%) in the intervention group and in the control group had good knowledge (p = 0.025). A similar trend was observed at three-month (p = 0.001) and six-month (p = <0.001) post-intervention, as described in Table IV.

Additional educational qualification, unlike gender, had significant effect on the medication reconciliation knowledge score. Table V describes the results of the one-way analysis of covariance carried out to adjust for the effect of gender and educational qualification of the pharmacists on their medication reconciliation knowledge. A significant difference was observed between the medication reconciliation knowledge scores of the study participants who had only the Bachelor of Pharmacy degree and those with additional qualification in the intervention group at baseline (p = 0.019), three-month (p = 0.040), and at six-month (p= 0.001) post-intervention.

Table III: Differences between the intervention and the control groups in pharmacists' medication reconciliation knowledge

Questions	Max. score	Baseline			Post-intervention								
		UCH (n=45)	UITH (n=30)	*p* value[a]	UCH (n=45)	UITH (n=30)	*p* value[a]	UCH (n=45)	UITH (n=30)	*p* value[a]	UCH (n=45)	UITH (n=30)	*p* value[a]
		Baseline			Month one			Month three			Month six		
		Mean (SD)			Mean (SD)			Mean (SD)			Mean (SD)		
1. Define CPMH	2	1.09 (0.56)	0.93 (0.58)	0.249	1.22 (0.47)	1.13 (0.63)	0.487	1.24 (0.44)	1.13 (0.68)	0.391	1.29 (0.59)	1.03 (0.72)	0.096
2. List three sources of generating CPMH	3	2.29 (0.87)	2.20 (1.10)	0.697	2.73 (0.54)	2.93 (0.25)	0.035*	2.78 (0.60)	2.90 (0.31)	0.249	2.58 (0.78)	2.77 (0.57)	0.260
3. Define MR	3	0.80 (0.87)	0.83 (0.87)	0.871	1.96 (0.90)	1.70 (1.09)	<0.001*	2.02 (0.72)	1.53 (0.94)	0.019*	1.67 (0.80)	1.37 (0.72)	0.300
4. What are the MR steps?	3	0.67 (0.80)	1.17 (1.15)	0.043*	1.98 (1.14)	1.70 (1.09)	0.295	2.49 (0.84)	1.97 (1.00)	0.017*	2.53 (0.89)	1.77 (0.90)	0.001*
5. Which professional is solely involved in MR?	1	0.02 (0.15)	0.17 (0.38)	0.055	0.38 (0.49)	0.03 (0.18)	<0.001*	0.27 (0.45)	0.13 (0.35)	<0.001	0.31 (0.47)	0.10 (0.31)	0.021*
6. What are the three care points for MR?	3	0.71 (0.92)	0.37 (0.81)	0.100	2.18 (1.13)	1.30 (1.20)	0.002*	2.40 (0.97)	1.53 (1.43)	0.006*	2.51 (0.94)	0.70 (0.99)	<0.001*
7. Differentiate between MH and MR	1	0.38 (0.49)	0.20 (0.41)	0.092	0.91 (0.29)	0.50 (0.51)	<0.001*	0.91 (0.29)	0.70 (0.47)	0.032*	0.96 (0.21)	0.70 (0.47)	0.008*
8. What percentage of drugs should be in CPMH?	1	0.89 (0.32)	0.60 (0.50)	0.007*	0.98 (0.15)	0.97 (0.18)	0.774	0.96 (0.21)	0.90 (0.31)	0.351	1.00 (0.00)	0.77 (0.43)	0.006*
9. Must patients know all medication indications?	1	0.93 (0.25)	0.83 (0.38)	0.211	1.00 (0.00)	0.93 (0.25)	0.774	0.98 (0.15)	0.90 (0.31)	0.202	1.00 (0.00)	0.97 (0.18)	0.326
10. Are dietary supplements part of CPMH?	1	0.93 (0.25)	0.77 (0.43)	0.062	1.00 (0.00)	0.93 (0.26)	0.161	0.98 (0.15)	1.0 (0.00)	0.418	1.00 (0.00)	0.93 (0.25)	0.161
11. Are non-oral medications part of CPMH?	1	0.89 (0.32)	0.77 (0.43)	0.189	1.00 (0.00)	0.97 (0.18)	0.326	0.96 (0.21)	0.97 (0.18)	0.813	0.98 (0.15)	0.97 (0.18)	0.774
12. Give two examples of non-oral medications	2	1.78 (0.56)	1.37 (0.81)	0.019*	2.00 (0.00)	1.83 (0.46)	0.057	1.80 (0.46)	2.00 (0.00)	0.005*	1.98 (0.15)	1.80 (0.48)	0.060
13. What is the proof of PC activities?	1	0.44 (0.50)	0.20 (0.41)	0.023*	0.84 (0.37)	0.47 (0.51)	0.001*	0.80 (0.41)	0.57 (0.51)	0.039*	0.89 (0.32)	0.43 (0.50)	<0.001*
14. What is the relevance of lab. result review?	1	0.69 (0.47)	0.67 (0.48)	0.842	0.93 (0.25)	0.97 (0.18)	0.525	0.87 (0.34)	0.97 (0.18)	0.106	0.84 (0.37)	0.930.25)	0.219
15. List three pharmacist-patient comm. barriers	3	2.18 (0.94)	1.63 (1.10)	0.024*	2.69 (0.60)	2.43 (0.73)	0.116	2.84 (0.43)	1.67 (0.71)	<0.001*	2.78 (0.47)	1.47 (0.73)	<0.001*
16. List two pharmacist-physician comm. Barriers	2	1.40 (0.72)	1.07 (0.91)	0.097	1.76 (0.48)	1.43 (0.68)	0.029*	1.78 (0.56)	1.33 (0.65)	0.004*	1.84 (0.48)	1.10 (0.61)	<0.001*
17. When is judgmental approach used for patients?	1	0.27 (0.45)	0.10 (0.31)	0.059	0.64 (0.48)	0.37 (0.49)	0.018*	0.67 (0.48)	0.27 (0.45)	0.001*	0.51 (0.51)	0.17 (0.38)	0.001*
18. List the drug therapy problems	8	3.04 (2.42)	3.73 (3.10)	0.309	5.67 (2.28)	5.93(2.23)	0.618	6.89 (2.13)	5.63 (2.21)	0.016*	6.96 (1.86)	5.07 (2.05)	<0.001*
MR knowledge mean (SD)	38	19.31 (4.76)	17.50 (6.86)	0.181	29.82 (5.01)	25.97 (5.31)	0.002*	31.53 (4.99)	26.10 (5.20)	<0.001*	31.69 (4.10)	23.07 (3.98)	<0.001*

MR = Medication reconciliation, CPMH = Comprehensive patient medication history, Comm. = Communication, PC = Pharmaceutical care, Lab. = Laboratory, SD = Standard deviation.

MH = Medication history, Freq. = Frequency, UCH = University College Hospital (Intervention site), UITH = University of Ilorin Teaching Hospital (Control site), [a] Independent-samples t-test, * $p < 0.05$

Table IV: Post-intervention changes in the categories of pharmacists' medication reconciliation knowledge

Questions	Baseline			Post-intervention								
	UCH (n=45)	UITH (n=30)		UCH (n=45)	UITH (n=30)		UCH (n=45)	UITH (n=30)		UCH (n=45)	UITH (n=30)	
	Baseline			Month one			Month three			Month six		
MR knowledge[a]	Frequency (%)		*p* value[b]	Frequency (%)		*p* value[b]	Frequency (%)		*p* value[b]	Frequency (%)		*p* value[b]
Poor knowledge (0-49.9%)	19 (42.2)	14 (46.7)	0.576	1 (2.2)	5 (16.7)	0.025*	1 (2.2)	2 (6.7)	0.001*	0 (0.0)	6 (20.0)	< 0.001*
Fair knowledge (50 - 69.9%,)	23 (51.1)	15 (50.0)		9 (20.0)	13 (43.3)		6 (13.3)	14 (46.7)		4 (8.9)	20 (66.7)	
Good knowledge (70 - 89.9%)	3 (6.7)	1 (3.3)		21 (46.7)	11 (36.7)		16 (35.6)	13 (43.3)		23 (51.1)	4 (13.3)	
Excellent knowledge (90 - 100%)	0 (0.0)	0 (0.0)		14 (31.1)	1 (3.3)		22 (48.9)	1 (3.3)		18 (40.0)	0 (0.0)	

[a] Percentage medication reconciliation knowledge = (MR knowledge total score/Expected total score) x 100%,
[b] Chi-square (Linear-by-linear association), UCH = University College Hospital (Intervention site), UITH = University of Ilorin Teaching Hospital (Control site).

Table V: Gender- and educational qualification-adjusted medication reconciliation knowledge of pharmacists

Variables	Medication reconciliation knowledge scores (Mean ± standard deviation)											
	UCH			UITH			Female	Male		Female	Male	
			p			*p*	Unadjusted scores		*p*	Adjusted scores		*p*
Gender	Female	Male	value[a]	Female	Male	value[a]	(Mean ± standard error)		value[b]	(Mean ± Standard error)		value[b]
Baseline	17.47±5.46	18.29±6.46	0.546	17.43±9.72	18.35±6.67	0.669	17.46±7.16	18.32±6.51	0.460	17.05±0.76	19.43±0.95	0.053
One-month PI	28.64±4.89	29.59±5.12	0.456	25.52±4.75	22.70±6.66	0.116	27.72±5.02	26.07±6.85	0.612	27.85±0.68	25.86±0.86	0.073
Three-month PI	31.06±5.28	31.87±4.69	0.610	25.17±5.54	22.89±4.36	0.219	29.55±5.89	26.97±6.35	0.065	29.72±0.88	26.73±1.05	0.033*
Six-month PI	32.39±3.96	31.24±3.11	0.310	22.00±4.55	23.75±3.51	0.231	29.28±6.32	27.19±5.01	0.115	29.33±0.89	27.13±0.93	0.091
	UCH			UITH			B. Pharm. only	Additional qualification		B. Pharm. only	Additional qualification	
Educational qualification	B. Pharm. only	Additional qualification	*p* value[a]	B. Pharm. only	Additional qualification	*p* value[a]	Unadjusted scores (Mean ± standard error)		*p* value[b]	Adjusted scores (Mean ± standard error)		*p* value[b]
Baseline	16.46±6.19	19.41±4.79	0.019	17.96±7.56	17.73±10.40	0.928	17.19±6.89	18.92±6.82	0.147	17.77±0.75	18.36±1.05	0.656
One-month PI	28.62±4.36	29.30±5.60	0.569	23.08±5.76	29.14±4.22	0.011	25.92±5.77	29.28±5.34	0.003*	25.97±0.64	29.18±0.87	0.004*
Three-month PI	30.00±6.05	32.83±3.10	0.040	23.16±4.63	27.00±5.52	0.112	26.71±.38	31.79±4.18	<0.001	26.80±0.80	31.63±0.1.11	0.001*
Six-month PI	29.69±4.36	33.21±2.53	0.001	22.77±4.16	23.80±3.55	0.505	25.68±5.43	30.79±5.00	<0.001	25.80±0.84	30.68±0.83	<0.001*

*$p < 0.05$, [a] Independent-samples t-test, [b] One-way analysis of covariance
UCH = University College Hospital (Intervention site), UITH = University of Ilorin Teaching Hospital (Control site), PI = Postintervention.

Discussion

Baseline medication reconciliation knowledge of the participants was poor. The educational intervention improved the medication reconciliation knowledge of the study participants in the intervention group over the study period. Additional educational qualification was the only demographic characteristic that had significant effect on the knowledge of participants in the intervention group.

At baseline, it was obvious that medication reconciliation knowledge of the pharmacists was below average. Most pharmacists at the study sites could not accurately define medication reconciliation. Also, the majority in the two groups at baseline neither understood the steps involved in medication reconciliation nor the critical care points where medication reconciliation may be required. This gives an indication that there was a probable lack of practice of medication reconciliation among pharmacists in the two hospitals.

Unexpectedly, half of the pharmacists could not differentiate between medication history and medication reconciliation. Medication history, which is the bedrock for medication reconciliation, is one of the patient-oriented services that pharmacists should be proficient at rendering (Johnston *et al.*, 2010). Failure to differentiate between medication history and medication reconciliation showed that the pharmacists obviously did not have a good understanding of

medication reconciliation at baseline. The majority of the participants erroneously believed that pharmacists could solely carry out the process of medication reconciliation without recourse to other members of the healthcare team. However, it has been established that it takes a collaborative effort from all healthcare practitioners to carry out medication reconciliation (Feldman *et al*., 2012). To avoid duplication of effort and needless tussles, there may be a need to spell out the specific roles of each member of the healthcare team (ASHP, 2013), especially in developing countries such as Nigeria.

On average, at baseline, pharmacists in both groups could only list about one-third of the categories of drug therapy problems using Cipolle and others (2012) classification. Medication reconciliation involves the identification and resolution of drug therapy problems with a view to ensuring patient safety. It is of great importance that pharmacists have a good grasp of drug therapy problems, which may also be discovered during the process of medication reconciliation. For example, a study in the United States of America showed that where pharmacy technicians duly trained by pharmacists could be involved in taking medication history, pharmacists identify and resolve drug therapy problems, which is their area of core competence (Petrov *et al*., 2018).

There was a misconception before the intervention among the pharmacists that judgmental approach could be employed in patient counselling in order to increase medication adherence. A non-condemnatory ambience is necessary during patient counselling in order for patients to open up to the pharmacists without fear of being judged. Judgmental approach may lead to patient withdrawal causing loss of information in the process of trying to ascertain patient's beliefs *vis-à-vis* the management of their ailments.

Pharmacists, on the other hand, need to keep a professional disposition even with the presence of medication non-adherence, but should rather find out the cause, educate patients to appreciate the implications of medication non-adherence and encourage patients to be medication adherent. A review by Sudulaguntla and others (2018) emphasised the need for pharmacists to adopt non-judgmental statements while communicating with patients. Several other studies also stressed the need to adopt a non-judgmental attitude in patient counselling (Kantchelov, 2008; NICE, 2012; MacPherson *et al*., 2013; Guiffrida, 2015). Pharmacists ought to communicate with patients and show empathy when there is a need for corrections. Thus, pharmacists may earn patients' confidence. Post-intervention, the understanding of pharmacists on the appropriate approach during patient counselling in the intervention group improved. Postgraduate education influenced the medication reconciliation knowledge of pharmacists. Although medication reconciliation as a new concept is not well known in Nigeria, those who had postgraduate educational qualifications might have been exposed to it. Also, the impact of critical thinking is brought to the fore as participants with postgraduate qualifications showed better medication reconciliation knowledge. A study done in Ireland by Drennan (2010) revealed that critical thinking skills are significantly higher among students with postgraduate education when compared with those without postgraduate education. This may call for review specifically to include medication reconciliation in the undergraduate curriculum.

Many studies have established the effectiveness of educational intervention in addressing knowledge gaps in clinical settings (Rajesh *et al*., 2011; Osakwe *et al*., 2013; Mahramus *et al*., 2014; Farha *et al*., 2018). Significant increment was observed in the intervention group pharmacists' knowledge of the subject matter across the six months of follow up. A combination of teaching styles which included didactic lectures, role plays, and theoretical case studies employed during the educational intervention, was obviously effective in addressing the knowledge gaps. The improvement could be seen by the increase in the scores for which most of them moved from '*below average*' and '*satisfactory*' at baseline to '*good*' and '*excellent*' post-intervention. A slight improvement was observed at the control site as their medication reconciliation knowledge increased from '*below average*' and '*satisfactory*' to '*satisfactory*' even though no intervention was done. This could have been due to exposure to the questionnaire, leading to their interest to engage in self-development.

To the best of the authors' knowledge, this is the first study carried out in Nigeria on medication reconciliation. This study has some limitations. Hawthorne effect cannot be ruled out based on the repeated administration of questionnaire to the pharmacists. Also, the results observed in the study cannot be generalised to all hospital pharmacists in Nigeria since the study was carried out among pharmacists in two tertiary health institutions. The high level of dropout is also a limitation to this study. Although the high dropout level observed in this study could affect the generalisation of the study findings, it however provides relevant data that can be further explored as regards medication reconciliation among hospital pharmacists in Nigeria.

Conclusion

Medication reconciliation knowledge improved after the educational intervention among pharmacists in the intervention group. It is recommended that this intervention be replicated in more hospitals in Nigeria to encourage the implementation of best practices.

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